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Diseases and Parasites of Minks

Farmers' Bulletin No. 2050

U. S. DEPARTMENT OF AGRICULTURE

1952

PREFACE

MINK RAISERS are producing approximately two and a half million pelts annually, and due to increased costs of production it is essential that losses from diseases be reduced to a minimum. This bulletin represents the results of experimentation and research on mink diseases covering nearly 10 years. Most of this work has been conducted in the cooperative field stations in Washington, Wisconsin, and other States.

This publication has been prepared primarily for use by any or all of the more than 8,000 mink raisers who make up our $50,000,000 mink industry. It has the endorsement of the National Board of Fur Farm Organizations, Morgan, Utah; the United Mink Producers Association, Lake Mills, Wis.; the Great Lakes Mink Association, Kenosha, Wis.; the Mutation Mink Breeders Association, Racine, Wis.; and the Mink Breeders Association of the United States, Elgin, Ill. The members of these organizations produce approximately 80 percent of the minks in the United States.

Commercial fur farming is a relatively new industry. Consequently, research has been limited and often has not kept pace with current problems. Ranchers, therefore, have had to depend largely on past experiences and their own resourcefulness.

Through these experiences, some of which were very costly, together with the limited research in Canada, Europe, and the United States, knowledge of diseases and parasites of minks has accumulated in the last few years. This bulletin is based largely on papers submitted to fur-farming journals. Its purpose is to provide a useful reference manual for the mink rancher. It does not encourage him to diagnose and treat diseases himself without the advice of a veterinarian. However, if he is able to recognize the common mink diseases, he will then know when to call for help and how to assist the veterinarian.

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DISEASES AND PARASITES OF MINKS

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DISEASES OF MINKS

DISEASES are here divided according to their cause—bacteria, viruses, nutrition, heredity, and miscellaneous, including poisoning and vices such as tail chewing.

There is always the possibility that an animal may be suffering from two or more diseases at one time. Consult a veterinarian for specific information if a disease breaks out in the mink herd.

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Washington, D. C. Issued November 1952

FACTORS IN PREVENTION AND CONTROL

Ranch Location

The ranch may be on any type of well-drained soil. Good drainage, such as is found in gravelly or sandy soil, helps to lower the incidence of disease; poor drainage favors the growth and spread of bacteria, viruses, and parasites. Good drainage is especially important if minks are to be kept on the ground. In the last few years, fur farmers have found that minks can be reared satisfactorily on wire mesh. This reduces the importance of good soil drainage. It is not good practice, however, to allow pools of stagnant water to accumulate under the pens.

When selecting a location for a ranch, consider the possibility of losses due to heat exhaustion. Minks get along very well in cold weather, but they do not tolerate extremely hot, humid conditions. As many of the desirable mink-raising areas are hot and humid, locate the ranch where there is a maximum of air circulation. Good ventilation often prevents losses.

Breeding Stock

Select breeding stock not only for fur quality, but also for good health and vigor. At first many ranchers found Aleutian minks difficult to raise. To increase the hardiness of this beautiful mutation, many ranchers found it necessary to outcross them with standard minks.

Live-Animal Shows

The live-animal fur show is a worthwhile project and should be continued at its present high standards. If a few precautions are followed, the danger of disease transmission through these shows becomes negligible.

First, show only animals that have been vaccinated against distemper. Expressmen often place minks next to dogs for convenience in feeding and handling during shipment. If the dogs near them have distemper, unvaccinated minks run a serious risk of becoming infected.

Second, isolate animals returned from a show. Place them in a separate shed for at least 50 days. This precaution also applies to the purchase of new breeding stock. Animals should be shipped only during the fall and winter and never before the breeding season, when no isolation period is practicable.

Proper feed and clean fresh water during transit are very important. In the feeding instructions to the expressman, specify the use of freshly ground, raw lean beef, but never hamburger. Use of hamburger permits too many substitutes which may be spoiled or decomposed. The feeding of spoiled hamburger has caused the loss of many valuable breeding animals. Fresh water should be available to the minks at all times.

Pens and Nest Boxes

The use of wire-bottom pens has greatly reduced the hazard of disease (fig. 1). Because internal parasites, such as coccidia, and external parasites, such as fleas, spend parts of their life cycles in bedding or soil, animals readily reinfect themselves and expose their pen mates when they are kept on the ground. Furthermore, this ground remains contaminated for some time and is capable of infecting minks that are later placed in the pen. Cement and board-bottom pens have the same disadvantages. They, however, are easier to clean and disinfect.

Nest boxes and kennels should be so constructed that they are easy to clean. Pelt in season any animals that are poor housekeepers—as evidenced by piles of droppings and uneaten feed—unless they are valuable breeders. This filth not only is a source of disease-producing bacteria, bacterial toxins (poisons), and parasite eggs and cysts, but it

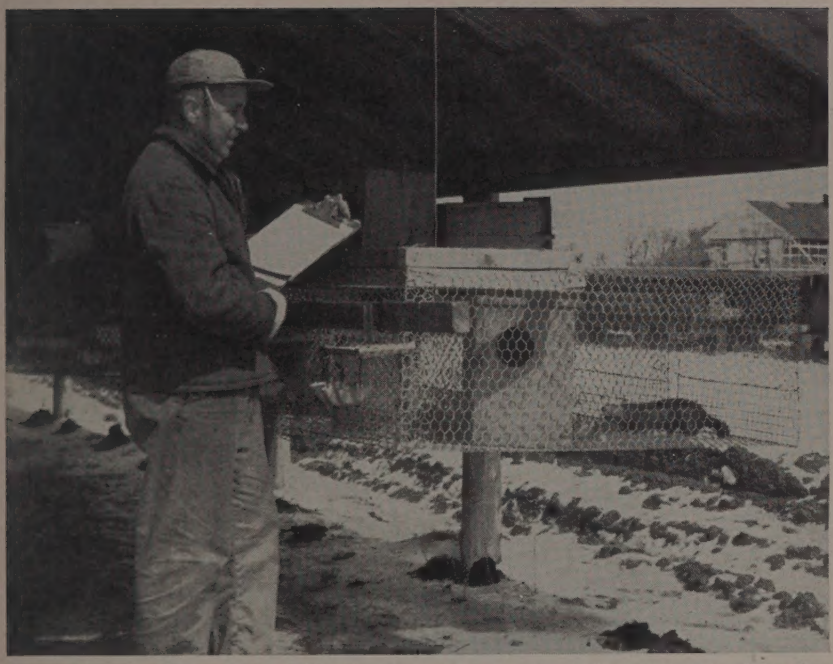

FIGURE 1.—A mink pen of a desirable type which is raised above the ground, so that the droppings cannot collect in the pen, but will fall down through the wire.

also attracts flies which may carry bacteria and viruses.

Guard Fence

It is important to have a fence that will prevent the loss of animals that escape from their pens and also keep out stray dogs, rats, and other animals that might introduce infections into the minkery.

Many mink ranchers keep dogs within the guard fence for protection. This is permissible if the dogs are vaccinated for distemper and not allowed to roam the neighborhood, where they might be exposed to it or to other diseases and carry them back to the stock animals. Cats are not susceptible to canine distemper. This fact, however, does not prevent these animals from carrying distemper virus from a dog back to the stock animals. Rats are potential spreaders of a large number of disease-producing organisms; they should be eliminated from the premises to protect the minks, as well as the health of the workers and their families.

It is not good practice to allow ferrets, pet coyotes, or racoons to run in the enclosed area. All these animals are susceptible to distemper and, if they become infected, can easily spread the virus. In a routine vaccination program in which a killed vaccine is used, all pets should also be protected.

Water and Feed Supply

Successful ranchers realize the importance of plenty of fresh water for their minks. The mink's natural habitat is near lakes and along streams and rivers. Minks can occasionally miss a feeding or two without harm, but they must have water every day. Withholding water for about 3 days will kill a mink. Under farm conditions, 1 day without water is likely to be fatal.

Many ranchers have a continuous-type watering system. Caution must be used, however, in constructing this system, because it may provide an excellent means of transmitting contagious diseases, particularly distemper, if all the minks on one side of a shed drink out of one long, narrow trough. As distemper virus is excreted in nasal discharges, one infected mink near the source of water might easily infect all those drinking, along the entire row. Always provide individual water containers when there is a disease outbreak.

Use of any feed of questionable quality is unwise. For example, meat containing a toxin may produce botulism, which can wipe out an entire mink herd within 2 or 3 days. If horse meat is used, be sure of your supplier, or do the killing yourself. Under no circumstances should meat be purchased from a rendering plant; there is always a chance of contamination or spoilage through improper handling and inadequate storage facilities.

Disinfectants

The importance of cleanliness in the care of minks cannot be overemphasized. Perhaps nowhere does the old saying, "An ounce of prevention is worth a pound of cure," hold so true as on the mink ranch. As a rule, it is much easier to prevent than to cure a disease. Minks are hearty, vigorous animals. They rarely get sick if they have an adequate diet and healthful living conditions.

To facilitate the use of disinfectants, it is important that all equipment and other construction be as simple as possible and easy to keep clean. If pens, kennels, feed houses, and feeding equipment are complicated and unhandy, disinfection may become too difficult for most ranchers.

As fecal matter and other organic material protect disease bacteria and viruses, thorough cleaning should precede disinfection. It is advantageous to have one agent act as both cleanser and disinfectant.

In the routine cleaning and disinfecting of pens and sheds on the small ranch, ordinary lye solution is effective and economical. One can of lye, which contains 13 ounces, is enough to make 15 gallons of cleaning and disinfecting fluid. If large areas must be covered, it is advisable to buy the lye in the form of caustic soda. Each pound will make about 20 gallons of solution, which does not need to be heated, although heating is advisable. In addition to acting as a disinfectant, lye cuts grease and partly dissolves and penetrates fecal material.

There are disadvantages in the use of lye. Concentrated lye is a poison and also is destructive to aluminum, paints, and clothing. In the dilute concentration recommended, it does not harm wood or iron, nor is it harmful to the animals in the amounts that might remain in the pens. However, quantities of the solution should not be left where the animals may drink it. The lye, during the disinfecting process, may be slightly irritating to the hands and face of the operator; consequently, precautions should be taken to avoid excessive exposure of the skin. As air soon converts lye into a relatively inactive substance, containers should be kept tightly covered.

Many ranchers now use steam under pressure to clean and disinfect pens and equipment. The steam is supplied by a steam jenny, which uses oil as fuel. Some ranchers have been fortunate enough to obtain this apparatus through war surplus; it can, however, be purchased commercially. When steam is used, it is a good idea to first soak the caked fecal material with water. If a good cleansing compound is used in the jenny boiler, it cleans and disinfects very satisfactorily.

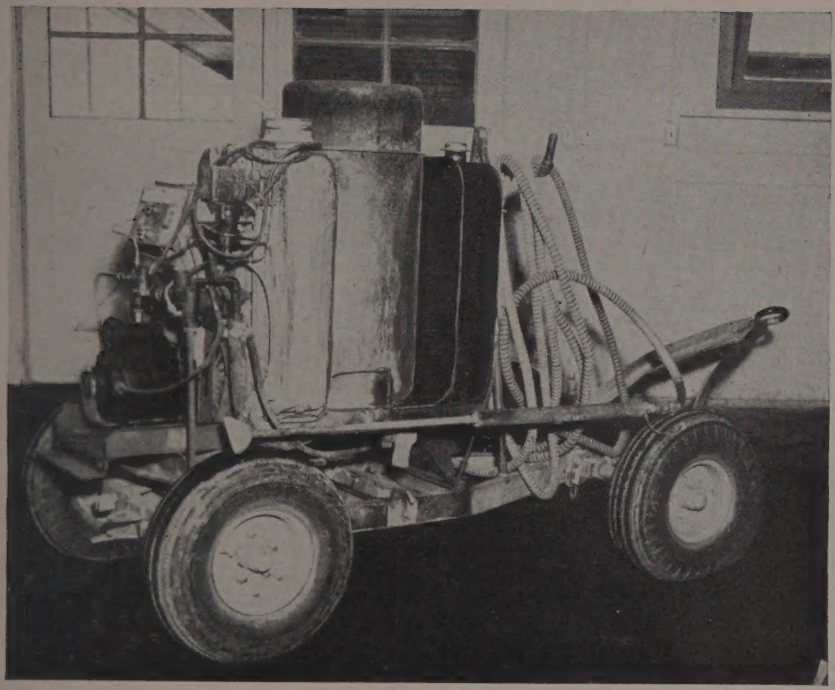

FIGURE 2.—A steam jenny, which does a good job in cleaning and disinfecting premises on many mink ranches.

On the model (fig. 2) used at the Fur Animal Disease Research Laboratory in Pullman, Wash., 80 to 90 pounds' pressure is most efficient in cleaning. Above 100 pounds, the steam is too dry and does not clean well. One disadvantage in the use of flowing steam is that in a small space without a draft there is such a cloud of steam that it difficult to see where to point the nozzle.

Use of cresol compounds on fur farms is not recommended. Severe inflammation of the feet of adult minks has been reported as a result of their use. One farmer who sprayed the inside of his nest boxes in the fall lost a large number of kits the following spring. Enough of the material soaked into the wood to burn the young minks so severely that they died. Cresols have a disagreeable odor and do not mix readily with hard water.

Although hot water alone is used to clean feed houses and feeding equipment on many successful fur farms, some of the new cleansing agents, or detergents, do a better job. If bought through a distributor, they are cheap enough for use on the fur farm. Their disinfective action is limited, but they are effective in cutting grease and in general cleaning. The routine use of these compounds on a ranch is recommended.

Disease Outbreaks

When disease breaks out, immediately isolate the affected minks from the rest of the herd. Clean and disinfect all pens, kennels, and feeding and other equipment with a 2-percent lye solution, which may be prepared by adding 1 pound of lye to 5½ gallons of water. This solution is effective against most

viruses and bacteria; however, if anthrax is present, a 5-percent solution is necessary. In using lye solutions, especially in strong concentrations, care should be taken to prevent injury to the operator or to the animals.

Cleanliness and care in avoiding contact with infection are always necessary, even when new disinfectants are available. Any dirt accumulation protects bacteria and nullifies the effectiveness of even the most efficient disinfectant.

Disposal of Dead Animals

Every ranch loses a few animals each year. If the animals are not submitted for autopsy, they should be so disposed of that there is no danger of their infecting the rest of the stock. To "throw them over the fence" is a dangerous practice, as rats, dogs, and flies may carry the disease back to the minks. Probably the most efficient and sanitary method of destroying carcasses is to burn them.

Also burn pelted carcasses, or sell them to rendering plants. Never feed them to the animals. The diseases and parasites that might be spread through an entire mink ranch are too numerous and damaging to justify the risk of infection for the small amount of meat obtainable from the carcasses.

BACTERIAL DISEASES

Botulism

From the standpoint of total losses, botulism is of minor importance to mink ranchers. However, it would be difficult to convince a rancher of this if he had lost all or most of his minks from botulism. Losses from it on individual ranches are usually very high.

Cause.—In the absence of oxygen, the botulism bacterium, *Clostridium botulinum*—commonly present in soil, vegetables, and manure—produces an extremely powerful toxin. Botulism is not a bacterial infection, but an intoxication resulting from eating foods in which the bacteria have multiplied and produced toxin.

Symptoms.—Outbreaks of botulism usually follow the same pattern. From 18 to 96 hours after meat containing the toxin has been fed, some dead and some paralyzed minks are found in the pens. At this time, a large number show no symptoms and appear normal, even though they too have been fed poisoned meat. Unless the entire herd is treated at once, the unaffected minks will probably show symptoms very soon.

An affected mink shows typical symptoms that should be known to every mink rancher, so that he can report the first cases immediately to a veterinarian. The onset of the disease is rapid. It is characterized by muscular incoordination and stiffness, followed by paralysis of the hind legs. In typical cases, the hind legs are affected first, but an initial paralysis of the front legs is by no means rare. At this time, the eyes are bright and the animal moves about by using its front legs and dragging its hindquarters. Soon respiratory symptoms develop, as evidenced by the heaving of the flanks.

Later the front legs and neck become paralyzed. A mink placed on its back is unable to turn over. When the animal is picked up and held over the palm of the hand, the front and hindquarters hang limp. The animal can no longer lift its head; if disturbed, it may cry weakly and bite the wire. Salivation is frequent, and the third eyelid (nictitating membrane) is sometimes paralyzed, though this condition is not constant. Death is commonly preceded by a short period of coma.

Prevention.—It is dangerous to incorporate the meat of a sick horse, or of any other sick animal, in the ration. It is also dangerous

to feed spoiled meat or a mixed ration that has had a chance to become warm for a time. Always keep the mix cool before feeding.

If botulism bacteria are present in food ingredients and the food is kept in a warm room, enough toxin may be produced to kill the animals. As the organisms are present in the intestinal contents of domestic animals and in the soil, care should be taken when slaughtering not to allow the meat to touch the ground and not to puncture the intestines when removing the viscera. Rats and mice may carry this organism and contaminate cereals and meat. Therefore, take every precaution to keep them out of the feed room.

Treatment.—In an outbreak of botulism, treatment of animals is often unsatisfactory. Prompt recognition and report of the disease when it first appears give the veterinarian a better chance to save the minks that have not eaten enough of the poisoned feed to show symptoms. Immediately remove feed suspected of being spoiled from the wire or feed boards and discard it.

If from the description of the systems the veterinarian makes a diagnosis of botulism, polyvalent antitoxin should be administered to every mink on the ranch as soon as possible. Depending on the size of the animals, the dosage should be from 4 to 8 cubic centimeters. If more than a single injection of antitoxin is needed the veterinarian will advise it. An autopsy will show little of significance.

Anthrax

Anthrax is an acute infectious disease caused by the bacterium *Bacillus anthracis*. Minks become ill by eating infected horse, cattle, or sheep meat.

Symptoms and autopsy findings.—Within a day or two after eating infected meat, minks often show the following symptoms: Depression, loss of appetite, vomiting, and finally muscular weakness and death. Autopsy reveals engorged blood vessels filled with black, tarry blood. The spleen is enlarged, dark red, and easily torn. A diagnosis can be made, however, by bacteriological examination only, because other conditions in minks often present a picture similar to that of anthrax.

Prevention and treatment.—Obviously, the best means of prevention is to feed no meat from animals that were sick before slaughter. A veterinarian who diagnoses anthrax in a herd usually prescribes injections of penicillin or some other antibiotic.

Man is also susceptible to anthrax. Therefore, burn dead animals; do not pelt them. It is very easy to become infected through the hands and arms by handling animals that have died from anthrax. The bacteria are highly resistant to heat and drying and can live for years on dried material and in soil. Never send pelts from minks dying of anthrax to market; they may infect anyone who handles them.

Abscesses

An abscess (boil) is an enlargement due to an accumulation of pus enclosed in a capsule. In minks, abscesses usually appear on the head and neck. The occasional abscess on an animal on most mink farms in the United States is not usually serious because the swelling opens by itself and drains, and the animal eventually recovers. On other farms where a large number of minks have abscesses which resist treatment and many of the animals die, the problem is not so simple.

Cause.—Abscesses usually are caused by slight injuries to the skin or lining of the mouth by slivers of bone or wood or bits of sharp ma-

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FIGURE 3.—An abscess above the shoulders of an adult mink that has opened and matted the fur.

terial in poor quality nest hay. These injuries allow a variety of organisms to enter. Abscesses develop from the infection.

Many times an abscess may result from an improper technique used in vaccinating. Veterinarians should always supervise any vaccination program. If the vaccine is contaminated with bacteria, each inoculated mink will have a large abscess within 5 or 6 days. Frequently, in the breeding season, aggressive males severely bite females. The resulting wounds often become infected and abscesses result.

It is also possible for bacteria to be introduced in the feed. Eating meat from a horse affected with fistula of the withers or with strangles may cause an outbreak of abscesses among minks.

Symptoms and autopsy findings.—Until the animals are near death, their appetites remain good. The affected animals can be easily picked out by their misshapen heads or necks. After the abscesses have broken a crust may form a cap over the animal's head. Such cases are difficult to treat. Unless the minks so affected are valuable breeders, they should be pelted in season.

The mink with an abscess (fig. 3) also usually has a greatly swollen, dark-red spleen. The liver is sometimes dull red, soft, and easily torn. Sometimes small abscesses are scattered through the organs.

Treatment.—After the abscess has come to a head, as evidenced by a hot, painful, fluctuating swelling, make a vertical incision with a sharp, sterile knife at the lowest point of drainage. The incision should be large enough to allow the pus to flow freely. Then wash out the cavity with a mild disinfectant and sprinkle it with a good healing powder. The local veterinarian can demonstrate this simple technique. In most cases it is well to give accompanying injections of penicillin.

Salmonella Infections

Fur-farming journals often mention *Salmonella* organisms as the major cause of enteritis (inflammation of the intestines) in minks. These reports have greatly overemphasized the relative importance of the bacteria. Minks with diarrhea are frequently said to have a *Salmonella* infection. Such diagnoses are often made without laboratory confirmation. The agents leading to or causing enteritis in minks are largely unknown. Recent reports suggest that this condition may be caused by a nutritional imbalance or a virus.

In an unusual outbreak, involving pregnant females, there were no deaths and the predominating symptom was abortion. *Salmonella* organisms were isolated from the uterus and from aborted kits in every instance. The original source of the infection was infected pork livers.

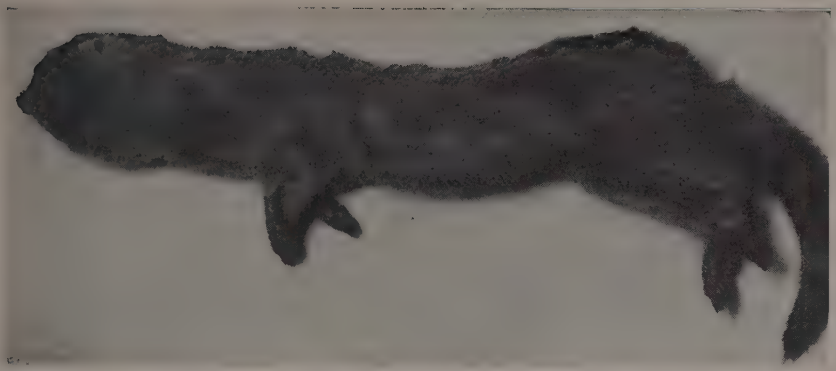

FIGURE 4.—Imperial Platinum mink, the head and neck of which are swollen from a streptococcus infection.

Streptococcus Infections

Streptococci induce different and seemingly unrelated disease symptoms. When many minks are infected, the streptococci probably have been introduced into the herd by the feeding of infected horse meat or beef. Meat from horses with strangles or fistula of the withers, and from cattle with acute mastitis, should not be fed to minks. Penicillin is the treatment of choice for streptococcic infections. This drug may be obtained from a veterinarian. If available, use long-lasting types of penicillin, as their effects persist for 1 to 3 days and fewer injections are necessary than with the other types. Good supportive treatment is also necessary. If the mink will eat, give it additional liver. If it refuses feed, injections of amino acids may be administered.

Acute Infections of Skin and Subcutaneous Tissues of Head

The rancher first notes this condition when the mink refuses feed and appears sluggish. Within a short time the head begins to swell, not as from an abscess, when the inflammation is usually confined to the side or top of the head, but over the entire surface. The top and sides of the head, also the nose, throat, and adjoining neck region are involved (fig. 4). Here the swelling stops and a raised edge circling the neck can be felt. This edge of the swelling is a distinctive feature of the disease. The eyes may be clear or may show a discharge. The lids are swollen. This condition may easily be confused with distemper, in which a swollen head and eyelids and an eye discharge are commonly observed.

To differentiate between the two diseases, an examination for the characteristic distemper inclusion bodies by a veterinarian or a diagnostic laboratory may be necessary. When the skin of the head is incised a thin watery fluid is released from beneath the skin. When abscesses are opened the exudate is thick and never clear. Other post mortem findings are not significant. In hydrocephalus the head is also swollen, but the swelling is caused by a large amount of fluid within the skull cavity.

Septicemia

The term septicemia refers to a condition in which the bacteria enter the blood stream. It is sometimes called blood poisoning. In both kits and adults it may cause serious losses. The symptoms appear rapidly; the animals either die quickly or are found dead with no previous symptoms.

Sinusitis

The term sinusitis means inflammation of the nasal sinuses. Occasionally seen in minks, sinusitis may be confused with distemper. The animals may have a discharge from the nose for as long as 3 to 4 months. Needless to say, in any condition in which a nasal or eye discharge is present, distemper must first be eliminated as a cause before other diagnoses can be made.

Streptococci are also isolated in cases of pneumonia, urinary-tract infections, bite wounds, or peritonitis. In pneumonia, however, one must always consider the possibility of a virus as the primary cause.

Tularemia

In some sections of the West jack rabbits often are numerous enough to serve as a substitute for horse meat in mink feeding. Among jack rabbits, however, there is a common disease known as tularemia or rabbit fever. This disease has been reported from all parts of the United States. Snowshoe rabbits, cottontails, and many other rodents also may carry the disease, and man may contract it.

Examination of a rabbit infected with tularemia often reveals many small white spots on the surface, and imbedded in the substance, of the liver and spleen. It is possible, however, for a rabbit to carry the bacteria and show no changes in the organs.

A few years ago, an outbreak in Illinois during whelping time was traced to two wild rabbits that the owner's dog had carried home. The owner ground the rabbits in with the regular ration, and 4 to 6 days later the minks became infected. They showed a loss of appetite and dullness, and died within a few days. Autopsy showed the typical spotted liver and bacteriological examination confirmed the diagnosis. At that time—1938—no biologics or drugs were available to combat the infection.

As an aid in preventing tularemia in minks, do not feed them sick rabbits or rabbits having a spotted liver and spleen. Furthermore, when rabbits are decreasing in numbers in certain areas, do not feed them to minks; they may be dying as a result of an outbreak of tularemia. The addition of an occasional wild rabbit to the ration is a very poor practice. The amount of meat obtained is small and the risk is great.

Although no experimental work has been done on the treatment of tularemia in fur bearers, streptomycin given by a veterinarian appears to be the therapy of choice.

Tularemia bacteria may enter the body through a wound, cut, or abrasion, or directly through unbroken skin. It is important, therefore, that skinners and others handling rabbit carcasses wear rubber gloves, even though the disease is not suspected. The bacteria have been found in carcasses 133 days after death, and in hides as long as 40 days. Thorough cooking of infected tissue, however, will kill them.

Tuberculosis

Tuberculosis, is one of the most common diseases in minks in Europe, but is rare in minks in the United States. Regulatory agencies, both State and Federal, have largely eliminated the disease in cattle, which is a source of meat for minks in this country. Tuberculosis is common in cattle in Europe.

The disease is usually recognized only at autopsy, as the symptoms shown by live infected minks are not characteristic. When the animal is opened for examination, many grey spots scattered through the lungs are seen. The lymph nodes are usually swollen, and the spleen may be four times its normal

size. Kidneys are often involved. Only rarely are the intestinal tract and liver affected.

There need be no concern with this disease in minks so long as there is little tuberculosis in cattle. Because chicken byproducts are fed them, minks might become affected with avian tuberculosis, common in the United States. European work, however, has shown that minks usually are susceptible only to cattle and human types of the disease.

Nonspecific Enteritis

An enteritis of which the definite cause is unknown frequently affects minks. It may be bacterial in origin. As there are other possibilities, such as a virus, however, it is useless to speculate as to the cause until more facts are known. The disease usually breaks out in warm weather on ranches where sanitation is not good. The feed house is often dirty, the meat grinder seldom cleaned, and refrigeration poor. Uneaten feed remains on the wire and old feed and feces are piled up in the nest boxes. These practices foster the agents that cause enteritis and often lead to and cause a severe outbreak. However, enteritis may also appear at times on clean, well-managed ranches.

Symptoms.—The symptoms vary. In acute cases, a mink may refuse to eat, have bloody diarrhea, and die within 3 or 4 days. In chronic cases, the animal may not die for a month, during which time it often has an excellent appetite. The food consumed apparently is undigested for the most part. The feces, instead of being bloody, as in acute enteritis, are often light in color and mixed with mucus. In such cases, the animal becomes badly emaciated before death. In other cases of chronic enteritis, the feces become black and fluid.

Autopsy findings.—Contrary to popular opinion, it is often difficult to diagnose enteritis at autopsy. The carcass must be fresh, for if the mink has been dead for even a short time, post-mortem changes (changes occuring after death) will mask changes due to the disease and make it impossible to diagnose the cause of death. This is particularly true in the intestinal tract, where the walls are rather thin and quickly become blackened. Shortly after death, the intestinal lining breaks down and the intestinal contents themselves become black and fluid. This quickly covers up the changes due to enteritis.

If the mink has been dead only a short time and the intestine is reddened and contains free blood, acute enteritis (fig. 5) evidently was the cause of death. If the wall is thickened and the animal has had intermittent diarrhea for some time, chronic enteritis is a safe diagnosis.

Treatment.—A veterinarian who diagnoses enteritis in a herd will prescribe drugs to alleviate the inflammation of the intestines of the affected animals and to combat the infection. Some of the new sulfonamides can be used to advantage by including them in the feed. Unfortunately, some outbreaks of enteritis are difficult to control, as the animals do not respond to treatment.

Pneumonia

Pneumonia is included under bacterial diseases, although little is known about its cause in minks. The term means an inflammation of the lungs. Except for enteritis, there are probably more inaccurate diagnoses of pneumonia than of any other mink disease. The reason is that the changes in the lungs preceding and following death from other causes often appear similar to those in pneumonia. This disease may appear as a complication in mink distemper. It often appears in the fall and spring, when the weather is damp and the temperature is subject to rapid changes.

Symptoms.—The most important symptom is the change in breathing, which becomes more rapid and is chacterized by a pumping action of the chest and abdomen. The mink refuses to eat and prefers to remain in the nest box. In some instances the nose and eyes show a discharge; in these cases distemper must be considered because of the similarity of symptoms.

Autopsy findings. — When the chest cavity is opened, the lungs appear dark red and firm to the touch. The whole lung may be involved, or the hard areas may be patchy. If the lung is cut with a sharp knife, pus can often be seen flowing from the small tubes. The thin sack that surrounds the lungs is often reddened and the spleen may be enlarged.

Prevention and treatment.—The nest box should be so constructed that it will have ample ventilation. This will provide protection not only against pneumonia, but also against heat exhaustion. If the box has poor ventilation, moisture from the heat of the body accumulates and condenses on the inside of the box during cold weather. There should be no possibility that the inside of the box, especially in outside pens, may become wet, because this condition sometimes leads to pneumonia. Good feed and a warm, dry nest box are the best preventive measures.

To treat the malady, penicillin or sulfonamides obtained from the local veterinarian are the drugs of choice.

VIRUS DISEASES

Distemper

Distemper is the most infectious and contagious disease of minks. Losses have been large and costly on ranches of all sizes. Some ranchers have been forced out of business entirely; others have lost thousands of dollars' worth of fur and breeding stock. Young minks, shortly after weaning, are the most susceptible. To keep losses low, obtain a diagnosis early in the outbreak and isolate all affected animals.

Cause and transmission. — The cause of distemper in minks is a virus—the same virus that causes distemper in dogs. Distemper in cats is a different disease and does not affect minks.

The mink distemper virus is easily destroyed by heat and also by most of the common disinfectants within a few hours, but it resists drying and low tempera-

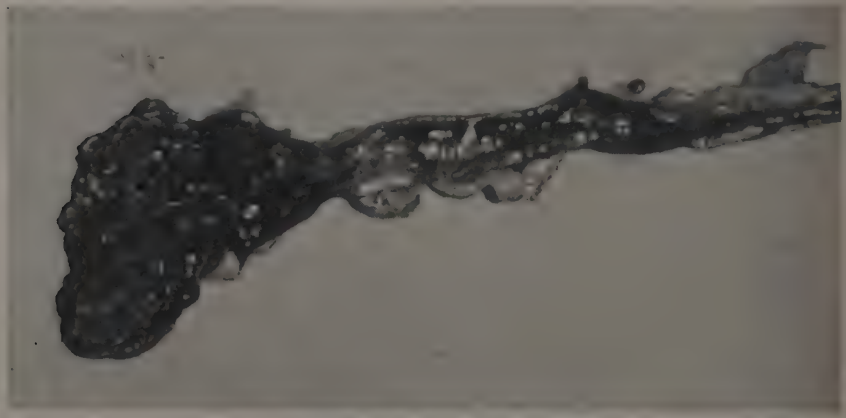

FIGURE 5.—Acute inflammation of the stomach and adjoining part of the intestine, which darkens the lining.

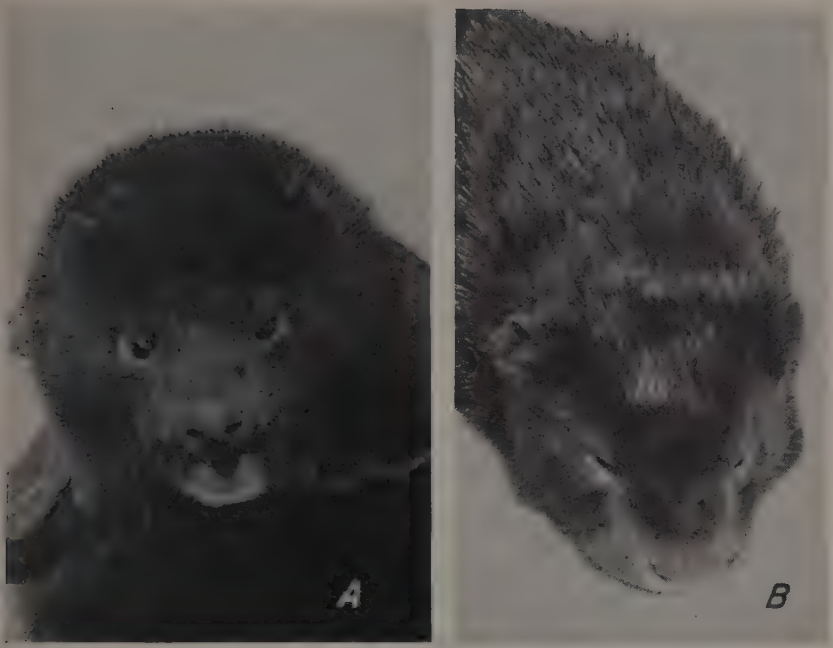

FIGURE 6.—*A*, First symptoms of distemper in a mink—squinty eyes, with a small white area around their edges; *B*, advanced symptoms of distemper—eyes almost closed with a pussy discharge and dried exudate around the nostrils.

tures for several days. It can survive for some time at temperatures below freezing.

Minks, dogs, and foxes infected with distemper transmit the virus by direct contact to the kits or adults. The infected secretions of sick animals may be transmitted for short distances through the air by coughing or sneezing. Because transmission may also be effected by contaminated feed or dishes, infected animals should not be brought into the feed house.

Symptoms. — A mink infected with distemper often has symptoms resembling those of other mink diseases. In a disease outbreak, consider first the possibility of distemper. In a typical case the early symptoms—poor appetite, dullness, and discharge from the eyes and nostrils—appear 8 to 14 days after exposure. The eyes blink excessively and have a squinty, wet appearance (fig. 6, *A*). The lids soon become stuck together with a pussy discharge (fig. 6, *B*). A similar discharge appears at the nostrils, where it dries and cakes. The head is often swollen. These symptoms, which may persist for a week or more, usually are accompanied by a swelling of the foot pads. Later examination will reveal a granular material on the swollen red surfaces of the pads (fig. 7). Thickening of the skin and loss of hair are not uncommon (fig. 8). At this time, the mink may go into a coma and die in a terminal convulsion. However, it may recover, the eye, nose, and feet symptoms meanwhile subsiding. Although it will have a good appetite and appear perfectly normal, a mink may later die in what ranchers term screaming fits. In this case the distemper virus has attacked and damaged the nervous system.

FIGURE 7.—A healthy mink foot pad (left), and one showing the condition in advanced distemper (right)—swelling and, on the surface, a branny material which adheres to the skin.

Autopsy findings.—It is difficult to diagnose distemper by looking at the lungs and the abdominal organs. Frequently, no changes other than an enlarged spleen are seen. Important changes are observed, however, if a piece of bladder or trachea (windpipe) is stained with dyes and examined under the microscope. If the mink has distemper, small bodies that are typical of the disease will appear in the cells of

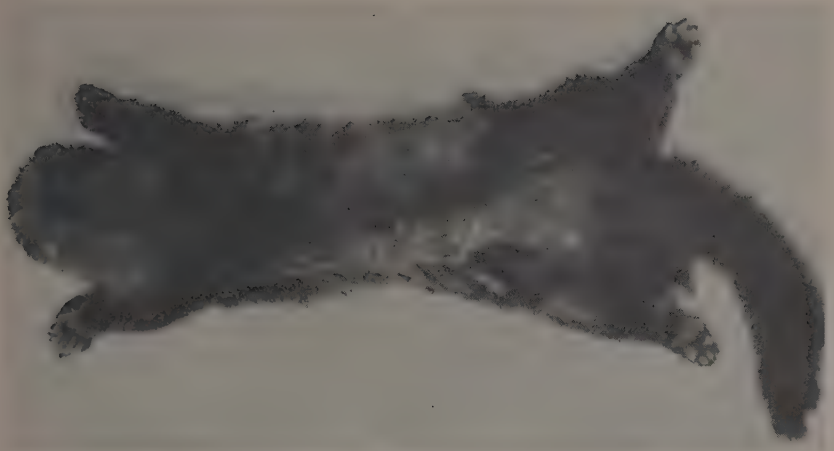

FIGURE 8.—Loss of fur in advanced distemper. The guard hair and underfur have fallen out, leaving bare areas.

these organs. Veterinarians often use this method to diagnose the disease.

Prevention.—Distemper is usually introduced into a group of susceptible minks by new breeding stock carrying the virus or by an infected dog. On many isolated farms where the source of the virus is not apparent, some insect or an animal other than a dog might act as a carrier of the virus.

As preventive measures, isolate new breeding stock and take special care to allow no infected dog near the minks. In order that such a dog can be easily recognized, typical signs of distemper in this animal are given: An irregular fever, dullness, loss of appetite, and a discharge from the eyes and nose (fig. 9). The discharge at first is thin and watery; later it becomes thick like mucus and tends to dry in crusts around the eyes and nose. If the lungs and air passages are involved, the dog coughs and has difficulty in breathing. In some cases, the skin has small red pustules; in others, diarrhea occurs. As in minks, the nervous form of the disease may appear in the later stages. A dog may have an almost continuous twitching of one leg, the forehead, or ears, a blinking of the eyes, or a champing of the jaw. Intermittent convulsions are usual; and the animal may become paralyzed. Death follows the appearance of these nervous symptoms in half or more of the cases. Dogs that recover are often left with permanent brain or nerve-tissue damage. However, the symptoms may not always be so severe as these. Instead, the animal may have only a slight eye discharge and not feel up to par. Nevertheless, it is still capable of transmitting the virus. A few dogs that have apparently recovered from an attack of distemper may be carriers and potential spreaders of the virus for a short time.

Despite marked progress in immunizing minks against distemper, the virus causes large losses each year. The protective method is use of a vaccine made of a killed suspension of the virus. Breeders are usually vaccinated after the pelting season and kits shortly after weaning. Recently, a live egg-adapted vaccine has come into use. Although the results have been encouraging, it is still too early to

FIGURE 9.—A young dog showing typical symptoms of distemper—exudate around the eyes and nose.

tell whether it will replace the older type of vaccine.

Treatment.—Unless an early diagnosis is made and the infected animals are isolated, treatment of infected minks is often unsatisfactory. The best procedure in an outbreak, is to isolate each mink as it breaks out with distemper and vaccinate all the survivors. Do not handle or shift animals more than necessary, as such manipulations may spread the virus through the pens. It is impossible to treat effectively animals with screaming fits (neurotropic distemper). The virus has caused irreparable damage to the nervous systems of such animals.

Enteritis

Enteritis in minks, recently shown to be caused by a virus, is fatal to kits. Breeders are apparently rather resistant. After a short incubation period, affected kits lose their appetite and pass soft, watery feces. Most of them die within 4 or 5 days. There are no vaccines for this malady. Control measures consist in good sanitary practices.

NUTRITIONAL DISEASES

Urinary Calculi

Urinary calculi, commonly called stones or gravel, are deposits of mineral salts in the kidneys, bladder, and urethra (the tube from the bladder to the outside) of minks. Calculus formation appears to be confined largely to certain areas of the United States. It is rare in Washington and Oregon, but common in the North Central States, where losses in male kits have exceeded 3 percent on a single ranch.

It is most prevalent among females in May and June, with losses in excess of 15 percent on some ranches.

The cause of urinary calculi is unknown. It is possible that combinations of factors predispose to the condition.

Symptoms and autopsy findings.— The symptoms of calculus disease are often difficult to recognize, or the presence of calculi in the animal is not known until an autopsy is made. Sometimes the symptoms are weakness, difficult urination, wet fur between the hind legs, straddling gait, paralysis, and terminal convulsions followed by death. The diseased animals are often in good flesh because the appetite remains good up until the time of death. Sometimes, however, the hair coat becomes rough and the animal refuses food, thus losing flesh before dying.

Calculi in female minks often hinder the normal contractions of the uterus and prevent birth of the kits.

At post-mortem examination, the kidneys and bladder should be examined for calculi (fig. 10). Where calculi are present and have resulted in the death of the animal, the stones are usually accompanied by blood and pus. Calculi range from the size of a millet seed or smaller to a size that fills the entire bladder. In male minks the calculus is often very small and may lodge in the urethra, where it curves around the pelvis bone or at the penis bone (fig. 11). In these cases the urinary bladder is often filled with bloody fluid. Calculi apparently form rapidly. Large ones have been found in bladders of kits 6 to 7 weeks of age.

Steatitis (yellow fat)

Steatitis has been recognized as such in various parts of the United States and Canada since 1942. It

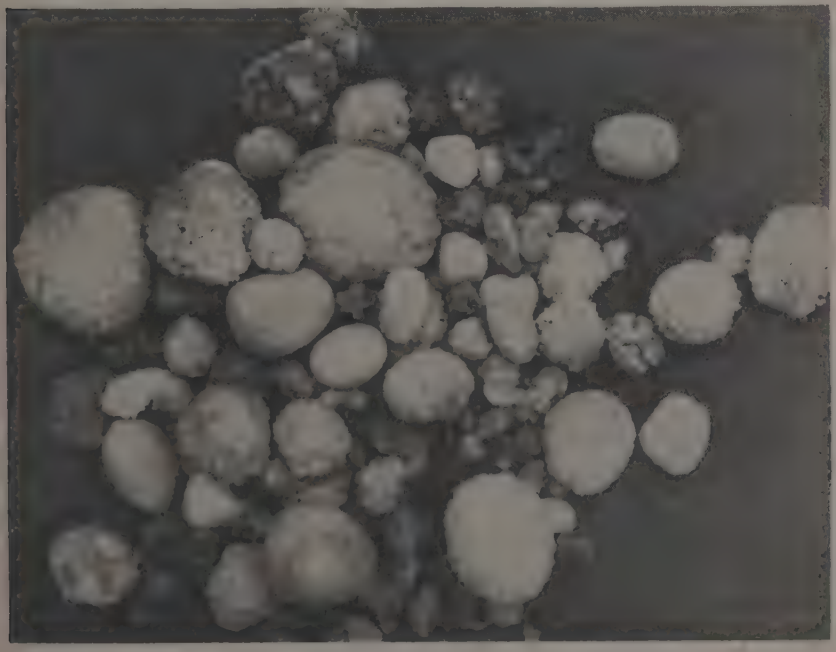

FIGURE 10.—Calculi removed from urinary tracts of minks.

FIGURE 11.—A small calculus lodged in the tube at the penis bone.

probably existed before that time, but was diagnosed as something else. A summer-fall disease, it affects young minks only. Losses from it have amounted to thousands of dollars on some ranches.

Cause.—The malady usually appears when ranchers feed high percentages of fish scrap and horse meat that have been in storage. Such diets often have a high content of unsaturated fatty acids and are low or deficient in vitamin E. Observations of natural outbreaks and laboratory experiments have shown that these two factors probably work together to produce the characteristic yellow-brown color of the fat.

Symptoms.—Kits are first affected shortly after weaning and after they have eaten large amounts of solid food. Outbreaks are most common the last 2 weeks in July and the first 2 weeks in August. Some, however, begin late in September and continue until pelting time.

Steatitis usually appears suddenly without warning. The kits may refuse the night feeding and be dead in the morning. Other affected kits may leave their feed and show a peculiar unsteady hop. The impaired gait may become progressively worse until the minks are unable to move. The animals remain comatose until death. In a typical outbreak half of the kits may die; often the survivors do not fur out well. At pelting time nearly all of the kits that survived will show yellow discoloration of the fat.

Autopsy findings.—At autopsy, the abdomen and groin appear thickened and feel doughy. When the affected tissues are cut with a knife, a thin watery fluid escapes. The fat beneath the skin and that surrounding the abdominal organs is a characteristic brownish yellow. The spleen is often enlarged as much as two to three times and may have dark blotches on it (fig. 12).

Prevention and treatment.—Because the disease often closely follows weaning, the female, as well as the kit, should have a ration adequate in vitamin E and other nutrients. In an outbreak, decrease the amount of fish or storage horse meat and substitute fresh horse meat and liver. Add wheat-germ meal to the ration. To each kit showing symptoms, give a 20-milligram dose by mouth of mixed natural tocopherols daily.

FIGURE 12. Steatitis in a mink kit, which resulted in a greatly enlarged, discolored spleen (arrow).

Nursing Sickness

A disease called nursing sickness, for want of a better name, attacks female minks, usually in late June, at about the time the kits are weaned, but sometimes after the kits have been removed. The cause of the condition is not known. It is believed to be brought about by a lack of calcium, phosphorus, or possibly some vitamin, or by some other nutritional deficiency.

Symptoms and autopsy findings.—Nursing sickness is easy to recognize. The female has had a large litter and becomes very thin and weak. Fur farmers sometimes describe the condition as snakey. At autopsy the animal is thin and dehydrated. The liver is often yellow and easily torn. Usually the gall bladder is full and the stomach empty. There is an almost complete absence of fat tissue.

Prevention and treatment.—About the only way to prevent the condition is to keep feed and water accessible to young kits at an early age. Carefully observe the condition of the nursing females at frequent intervals. If one becomes thin and dehydrated, remove her kits. If they are too small to be weaned, give them to another female. If they are left with their natural mother, she will surely die.

Once the female has refused feed, it is difficult to get her to begin eating again. Some ranchers try to stimulate her appetite by putting a young chicken into the pen or by feeding bits of liver. Unfortunately, however, many females die despite all attempts to save them.

Pregnancy Disease

Pregnancy toxemia may occur usually a few days before whelping. The cause is not clearly understood, although it may be nutritional. The disease is often a serious problem and causes losses of unborn kits as well as of the females. Additional fresh liver in the ration may help prevent the condition. No characteristic post mortem changes are seen.

Nutritional Anemia

Nutritional anemia — sometimes called acidosis, disease of the sheath, or wet belly—is common in minks in the United States. Research at the Ontario Veterinary College indicates that this ailment may be associated with a lack of or too little liver in the diet. The malady is characterized by loss of weight, rough dry coat, and poor appetite. The sheath in the male becomes irritated, swollen, and inflamed. Soon the animal appears anemic as evidenced by a pale mouth, tongue, and foot pads. Death is usually preceded by a terminal convulsion. Near the beginning of the breeding season the inguinal regions of male minks frequently become damp. This is not to be confused with nutritional anemia.

Chastek's Paralysis

The cause of this paralysis was discovered on the Chastek fur farm at Glencoe, Minn. Dr. Robert Green and his coworkers found that raw fish in the ration was causing paralysis and death in Chastek's foxes. Research workers discovered that the raw fish contained a factor that caused the destruction of vitamin B_1 (thiamine). Feeding fish that contain this destructive factor—an enzyme—daily to either foxes or minks deprives the animals of all sources of thiamine. Reserves of the vitamin are soon used up. Minks then go off feed, become paralyzed, and die.

The nutritional disease may be prevented by cooking the fish to destroy the enzyme, by removing raw fish from the diet, or by feeding raw fish on alternate days. A local veterinarian can give intraperitoneal injections of thiamine to treat the paralysis. Include ample

amounts of brewer's yeast in the diet. In case of an outbreak, immediately remove uncooked fish from the diet.

Carp, suckers, saugers, goldfish, burbot, white bass, whitefish, creek chub, ocean herring, bullheads, and channel cats contain this enzyme. Research at Oregon State College has shown that Chastek's paralysis may be experimentally produced in minks and foxes by feeding them diets composed of 50 percent of fresh-frozen smelts.

Rickets

At one time rickets was rather common in ranch-raised minks. It is a deficiency disease of kits, usually caused by a lack of vitamin D, with resulting upset of the metabolism of calcium and phosphorus. Rickets may result from a deficiency of one or both of the two elements.

Rickets is not difficult to recognize in advanced cases. Because of the pull of the muscles on the soft bones, the back legs are bent outward and look like those of a frog. The weight of the body itself often bends the soft bones, forming the so-called sabre legs. The affected kit remains small and has a poor appetite. Its coat is thin and shaggy.

The levels of fish oil in the common diets are apparently sufficient to supply the vitamin D required. Most rations contain enough calcium and phosphorus in the form of ground green bone, bone meal, commercial cereals, and mineral supplements. If kits are kept entirely in the shade, rickets is more likely to occur, for want of vitamin D. This vitamin is formed in the skin of the mink by the action of ultraviolet light.

To treat rickets on a ranch, add ample high-potency vitamin D fish oil, together with a supplement containing calcium and phosphorus. All affected kits should have plenty of sunlight.

Gastroenteritis

Gastroenteritis (inflammation of the stomach and intestines) has been produced by lack of factors found in fresh liver and raw milk. The symptoms noted in experimental studies of minks were weakness, loss of appetite, and bloody diarrhea. The origin of black droppings, commonly mentioned by mink ranchers, may be nutritional at times. The addition of tomato pomace and fresh liver has alleviated the trouble on some ranches. Perhaps nutritional enteritis is more common than has been believed.

Fatty Change of Liver

Fatty change of the liver, often referred to as fatty degeneration, is frequently found on post-mortem examination of minks. It should not be considered as a separate disease, but rather as an abnormal change accompanying many disease conditions.

Fatty change of the liver (fig. 13) is common in intoxications resulting from bacterial toxins, toxic products of metabolism, or chemical poisoning. It is common in nursing sickness. Kennedy has reported it in nutritional anemia. The change can be produced experimentally by starvation and by including excessive fat in the ration. Significant fatty change of the liver is not found in experimental or actual field cases of steatitis (yellow-fat disease).

Because of the accumulation of fat in the cells of the liver, that organ is in this case yellowish or clay colored. It may be softer than usual and it has a tendency to separate into small pieces. When the liver is cut with a cold knife, a film of grease remains on the blade.

The diagnostic value of fatty degeneration is limited, because it is seen in many disease conditions.

Therefore, do not attempt to treat fatty change of the liver as such, but rather look for the actual cause to provide a sounder basis of therapy.

HEREDITARY DISEASE, HYDROCEPHALUS

Hydrocephalus, also called water on the brain or bighead, occurs in mink kits soon after they are born. It is characterized by a great distention of the part of the skull that covers the brain (fig. 14). In recent years more cases than formerly have been brought to the attention of veterinarians, and the malady appears to be widely distributed. Many cases never become apparent because the affected kits die soon after birth and are eaten by the females. When the condition establishes itself in the breeding stock it can become very serious and difficult to eliminate.

Cause.—Hydrocephalus is noncontagious and, as far as is known, is not caused by any nutritional factor, but is hereditary. In rare cases it is caused by accidents in development during the gestation period, under which circumstances it is not inherited.

Symptoms.—The affected kit is usually first noticed when animals in the litter are counted and examined after whelping. The greatly enlarged head, dullness, lack of size, and muscular incoordination are the predominating symptoms. When the individual is picked up and the head is examined more carefully, the part of the skull housing the brain is seen to be greatly distended and fluctuates to the touch. The skull in this area is soft; in some places the bone is absent altogether.

The underlying cause is an accumulation of fluid within the cavities (ventricles) of the brain. The resulting pressure forces the brain substance against the soft developing bones of the skull, arching them outward. The pressure on the brain and the retention of fluid cause the dullness and muscular incoordination. When the swelling is incised, much colorless fluid escapes and a large cavity is revealed.

Control. — Hydrocephalus in minks is, in most cases, assumed to be a heritable lethal character produced by recessive genes. It may appear on a ranch as suddenly as a

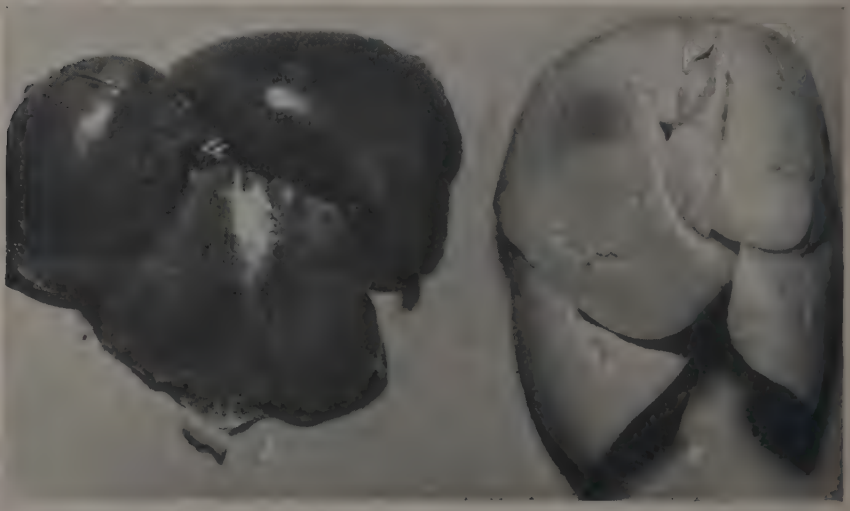

FIGURE 13.—*A*, Liver from a healthy mink; *B*, a light-colored liver, showing fatty change.

FIGURE 14.—Hydrocephalus in a mink kit—distended, softened skull revealed by removal of skin.

new color-phase mutation. Like other recessives, hydrocephalus may remain hidden for several generations, becoming apparent only when both the male and female parents carry the hydrocephalic genes and transmit them to their offspring together.

If the malady appears, destroy the affected kit. It will only take nourishment from the female and die in a short time. Then pelt the sire, the dam, and the litter mates of the hydrocephalic kit. Both the sire and the dam are carrying the gene and all or most of the litter mates may carry it. If followed each year, these practical measures should eliminate the trouble.

POISONING, VICES, AND MISCELLANEOUS AGENTS

Red Lead Poisoning

Each year a few mink ranchers suffer disastrous consequences from red lead on their equipment. Although it is a good preservative, red lead should never be used on wire, water and feed dishes, or on any other equipment with which minks may come in contact. A little red lead paint on a wire-bottom pen, for instance, can cause the death of healthy minks.

Symptoms and autopsy findings.—Acute lead poisoning occurs when minks are placed on wire immediately after it has been painted with red lead in oil. For 2 or 3 days the animals appear normal, but soon they act sluggish and show no interest in their feed. These symptoms are followed by muscular incoordination, stiffness, trembling, complete loss of appetite, dehydration (removal of water from the body), and mucopurulent discharge around the eyes. About a week after they are placed in painted pens, the animals have a terminal convulsion and die.

Wire treated with red lead causes chronic lead poisoning among minks placed on it, even when it is thoroughly dry. Wire-bottom pens may be dangerous for some time after they have been painted. In chronic red lead poisoning, no characteristic symptoms are seen. The animals lose weight gradually and die in 25 to 40 days.

Post mortem examination shows no characteristic changes that can lead to an accurate diagnosis. As there are no significant symptoms or post mortem findings, diagnosis must be based on the report that the animals had been kept on wire that had been treated with red lead.

Treatment.—When a diagnosis of lead poisoning is made, remove the animals from the painted pens as soon as possible. While in the pens the minks are constantly consuming a small amount of lead each day from chewing on the wire or other painted equipment.

Give the survivors adequate amounts of calcium in their ration each day. This may be in the form of dicalcium phosphate or calcium gluconate, obtainable from the local veterinarian. Treat animals for at least 2 months, gradually reducing the dosage during that time. Simultaneously, an ample amount of fresh fish oil to supply vitamin D is necessary. The calcium and vitamin D tend to prevent the lead from circulating in the system and to store it in the bones, where it will do little harm. After it is stored in the bones it is slowly eliminated from the body.

Other Poisoning

Many materials can poison minks. Because the animals are confined to a small space, the major possibilities are poisoning from materials sprayed on them or the pen, and poisoning from some toxic material in the feed. Poisonous spray materials include DDT, creosote, sulfur, and benzol benzoate compounds. Poisonous material may be mistaken for a feed ingredient and added to the ration. For example, commercial fertilizer mistaken for bonemeal.

Feeding Poultry Waste

Breeding failures on many mink ranches have been attributed to the feeding of poultry waste containing heads from chemically caponized birds, known in some localities as caponettes. The chemical, a hormone-producing drug, diethylstilbestrol, is implanted as a pellet in the neck of the bird a few weeks before it is to be marketed. The pellet gives the same results as surgical caponization and is more convenient.

Apparently when the caponette heads are fed to minks, enough of the pellet remains to interfere with reproduction and cause breeding failures in both male and female minks. If poultry heads must be fed as a source of meat, the rancher should throw out all the heads so treated.

Foreign Bodies

It is not uncommon for a mink to have small bone splinters stuck in the corners of its jaw in such a manner that it is unable to close its mouth. When fed ground turkey heads, a mink frequently gets one of the small rings of the turkey's windpipe encircled and lodged around its tonque. The symptoms shown by the affected mink appear about the same in either case. The animal seems hungry, yet refuses to eat. Saliva collects at the corners of its mouth, and the mink scratches at its mouth. The mouth should be opened and the bone or ring of cartilage removed.

Minks occasionally consume quantities of bedding, splinters of wood, or such other materials as pine needles. This depraved appetite often leads to impactions or perforations of stomach and intestine.

FIGURE 15.—Marked fur chewing by a Silver Blu male mink.

Tail Chewing and Fur Clipping

Nothing disgusts a mink rancher more than an animal that chews its tail or clips its fur. Fur journals contain many suggestions from ranchers and veterinarians on how to cure or prevent this vice. One method may be successful in some cases, but not in all. Undoubtedly, close confinement and an inadequate ration predispose to tail chewing and fur clipping. Few trappers have found wild minks that mutilate themselves in such a manner.

Fur clippers chew off all the hair they can reach. This gives them a lionlike appearance (fig. 15). Strangely, few animals show any ill effects from their diet of hair. They often stop chewing their hair for a month or two. If they ever get a full prime coat, it is well to pelt these animals, as they may begin chewing again at any time. A tail chewer first sucks its tail, much as a child sucks its thumb. Soon it begins to chew the flesh and bone. It is not uncommon for a mink to chew off its entire tail and continue chewing until death results.

Heat Exhaustion

Heat exhaustion is a paralysis of the heat-regulating mechanism caused by prolonged exposure to excessive heat, either from the sun or from confinement in a close, hot place. By far the greatest losses are at whelping time when young kits are housed in humid, poorly ventilated pens. The danger is considerably reduced if there is free movement of air.

When the females are whelping, or if the kits are only a few days old, the losses may be very high. The female is also affected by heat. She may not take care of her kits, or she may maul and drag them out on the wire, where they are killed by the direct rays of the sun or where they fall through and are lost.

Symptoms and autopsy findings.—If the female is whelping and the weather is excessively hot and humid with no air currents, the young kits may die so rapidly that no symptoms can be observed. The female does not clean them properly and is in distress herself. She may lie in the doorway of the nest box, thereby shutting off any air currents that might otherwise enter. The nest box then becomes exceedingly hot and the kits are suffocated.

Later in the season, when the kits are older, on a hot, humid day the rancher may find some of his kits dead and others affected. These older animals, however, usually show typical symptoms.

First the older kits become quiet and stretch out on their sides. As the day progresses and becomes hotter and more humid, they look anxiously for shade and water. If a rancher reaches for a kit at this time, it may turn on its side and cry weakly in protest (fig. 16). The kits appear extremely nervous and bite at the wire. They breathe rapidly, and the young minks must crawl on their stomachs to move. Saliva soon gathers at the corners of their mouths and the animals may have a terminal convulsion or go directly into a coma and die. This chain of symptoms may occur in a surprisingly short time.

FIGURE 16.—Young mink kit showing symptoms of heat exhaustion. It is unable to move rapidly; when disturbed it will turn on its side and cry weakly.

At autopsy, the lesions are often indefinite. However, a marked congestion of the lungs is usually found. The large veins are often distended, and the blood fails to clot. Small hemorrhages are occasionally seen on the thymus gland. Since the carcass is hot, decomposition is rapid.

Treatment and prevention.—Unfortunately, not much can be done to help the individual kit at whelping time. Older kits have been successfully revived by dipping them in lukewarm water. After dipping, place them in the shade, where there is free circulation of air. As a stimulant in advanced cases, place a drop or two of aromatic spirits of ammonia on the tongue.

Watering frequently—as often as 10 times a day during hot, humid weather—is a preventive.

Large lawn sprinklers aid in cooling a small yard. Overhead pipe sprinklers, such as those used in nurseries, can be placed in yards where large numbers of minks are held. When sprinkling, do not allow any of the cold water to fall on the young kits; the sudden shock might kill them.

Many ranchers find aluminum-roofed sheds very satisfactory because they are durable and fairly cheap. The aluminum sheeting reflects the heat. On the hottest days, these houses are relatively cool. If the sheds are built in a north and south direction, check closely to see that as the sun passes overhead its light does not reflect off one slanting roof onto the young kits in the shed parallel to it. With a certain pitch of the roof this may easily occur. The situation can be remedied by putting up canvas shades on the side of the shed to block the reflections.

Some mink raisers lay burlap bags on the wire and wet them down. Evaporation of the water helps to keep the pen cool. The lid of the nest box can be opened and the hay removed to help the circulation of air.

PARASITES OF MINKS

Minks are susceptible to a number of insect and worm parasites. Only a few are of great economic importance at present. However, those not now important may become so if methods of feeding, handling, and housing minks are changed. Moreover, some of the parasites now found only in wild minks might cause grave concern should they become established in captive minks.

The best preventive measures against these parasites are good sanitation, good housing, good feeding, and a knowledge of the potential parasites and their life cycles. Whether or not a living animal is infected with worm parasites may usually be determined by microscopic examination of the manure for worm eggs (p. 37).

PARASITE CONTROL

On most ranches where good husbandry is the rule, minks are rarely infested with parasites. Ranchers who practice good sanitation and

hygiene may never experience an outbreak of coccidiosis or a flea infestation. Modern pens are so constructed that they can be kept clean and free of infective forms of parasites.

Few remedies for the removal of internal parasites of minks are either safe or effective. To remove worms, drugs must be powerful, and they are not easy to administer to minks. Prevention of infection with parasites is far preferable to treatment. Supply feed from reliable sources, remove manure frequently, use proper disinfectants when necessary, flyproof nest boxes, and use wire-netting floors and sanitary water containers. Parasite prevention is necessary for profitable mink ranching.

Always keep recently purchased animals in quarantine for some time and check them for parasites.

EXTERNAL PARASITES

Fur animals frequently become infested with the larvae—maggots or grubs—of flies. Older animals are rarely infested; young kits, sometimes those only 1 week old, are the usual victims. Among the flies producing these infestations are the green-bottle flies (*Lucilia* spp.), the black blowflies (*Phormia regina*), the rodent botflies (*Cuterebra* sp.) which are accidental invaders of mink kits, and the gray flesh fly (*Wohlfahrtia* spp.).

As a rule, most of these flies, except *Wohlfahrtia* and *Cuterebra* spp., do not deposit their eggs or newly hatched maggots on the clean unbroken skin of a sick animal or young kit. They prefer soiled fur, infected wounds, open sores, cuts, or discharges from the natural body openings. In these infested areas the maggots flourish and, if they migrate and feed inwards, they may cause considerable damage or death.

Gray Flesh Fly

The gray flesh fly (*Wohlfahrtia* spp.), two species of which occur in the northern United States, is widely distributed. It probably causes greater annoyance and loss of mink kits than does any other maggot-producing fly. Kits are most frequently attacked by it when they are about 5 weeks old.

The fly responsible for this maggot invasion of kits is about twice the size of the ordinary house fly. It is black and gray and rather slow in its movements. The adults feed on such sweet materials as nectar of flowers, especially that of sweet clover. The females avoid bright sunlight; hence the dark nest box is a desirable place in which to find their prey. They are not attracted to animals or animal products until a female is ready to liberate her offspring. At this time the female fly strikes at various parts of her victim, but she seems to prefer the face, neck, flank, and areas around the natural body openings. Once she finds a suitable spot, she deposits a white mass of eggs that is rapidly transformed into moving maggots. The maggots soon attempt to bore into the skin, usually not being able to penetrate the skin of the adult but readily breaking through the skin of the newborn kit (fig. 17).

Once they have penetrated the skin the maggots develop rapidly and in 3 or 4 days may attain a length of 15 millimeters. They remain under the skin for 9 to 14 days. Then they leave the mink and fall to the ground. Here they go into the resting, or pupal, stage, and in due course become adult flies. The entire life cycle may be completed in a month during warm weather and under the most favorable conditions, or it may be prolonged for 7 to 8 months if it began in the fall.

The gray flesh fly is abundant from June to September, the period of greatest attack usually being in June. Minks of late-born litters are more likely to become infested than those of earlier litters.

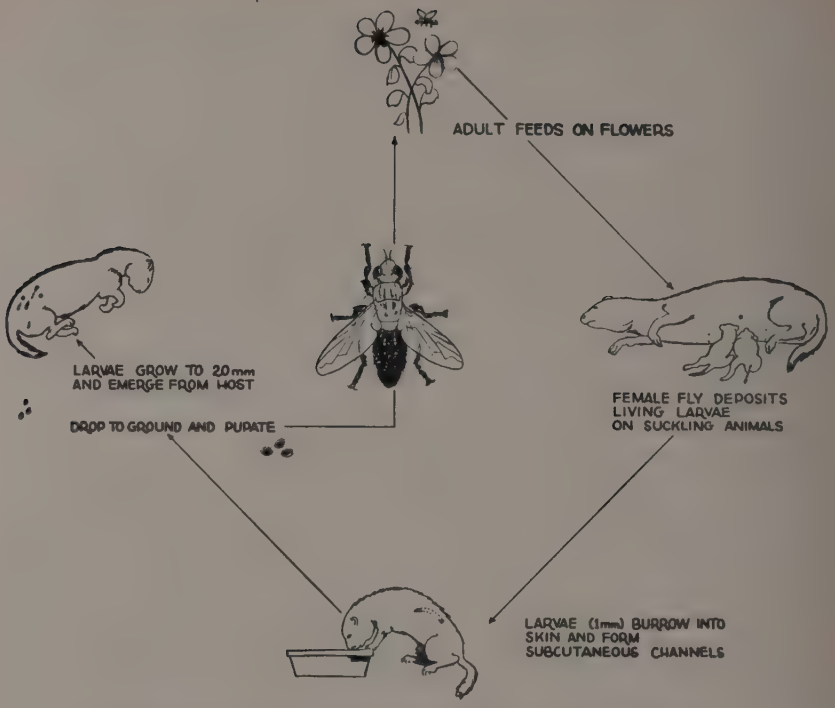
ADULT FEEDS ON FLOWERS
LARVAE GROW TO 20 mm AND EMERGE FROM HOST
DROP TO GROUND AND PUPATE
FEMALE FLY DEPOSITS LIVING LARVAE ON SUCKLING ANIMALS
LARVAE (1mm) BURROW INTO SKIN AND FORM SUBCUTANEOUS CHANNELS

FIGURE 17.—Life cycle of the gray flesh fly (*Wohlfahrtia vigil*).

Symptoms.—A small area at the point of the maggots' penetration becomes reddish. Serum seeps from the irritated area and the fine fur surrounding it becomes matted. As the maggot grows there develops a boil-like lesion that has a small opening through which the maggots obtain air (fig. 18).

While skin penetration is in progress the young minks become extremely restless and may whine pitifully. The nursing mother often drags them outside the nest box, where they may die from exposure. The constant irritation, restlessness, and lack of appetite brought about by this maggot invasion may soon result in exhaustion and emaciation of the kits and are often followed by death.

Treatment. — Although many ranchers do not like to handle kits until they are several weeks old, examination of the kits every second day is necessary to control the gray flesh fly. This examination entails considerable labor, but it is the most effective method in reducing losses from the fly. Remove kits known to have maggots and treat them. Injecting hydrogen peroxide, chloroform, or ether into the abscess opening usually makes the maggot back out. It then may be grasped with a blunt forceps and removed. Sometimes the maggots may be squeezed out of the small pockets. Once they have been removed, treat the wound with a mild nonirritating antiseptic, such as argyrol diluted in the proportion of 1 part to 20 parts of water.

Prevention.—Preventing the infestation of mink kits with the gray flesh fly is by no means easy. It can be accomplished by screening, but such a procedure is often costly and impractical, especially if the screening of individual pens is attempted.

FIGURE 18.—Taking a flesh fly maggot from a hole in a mink kit's skin.

The use of insecticides and fly repellents is limited, as such products must be used with caution inside nest boxes. Spraying the outside of the nest boxes with a DDT mixture may reduce the fly population. Keep lids of the nest box tightly closed. To allow adequate ventilation, remove a 2-inch strip of wood below the lid and replace it with a piece of fly screening. Brush the screen occasionally to keep it free from dust and lint.

Fly traps around the pens may help in reducing the fly population. Although always desirable, sanitation and hygiene do not play so important a part in the control of this fly as in the control of other flies. The gray flesh fly is not attracted by filth, putrid meat, or unpleasant odors. However, fly traps baited with such materials as honey, molasses, and brown sugar may attract them and lessen the general fly nuisance.

Grubs of Rodent Botflies

The grubs of rodent botflies, (*Cuterebra* sp.), which frequently infest rabbits, squirrels, field mice, deer mice, several other rodents, and domestic kittens, occasionally infest minks.

The adult fly is large and prefers to lay her eggs in dark surroundings. Little is known as to how the grubs that hatch from the eggs enter the skin of the host animal. Once under the skin, they grow to be three quarters of an inch long and almost half an inch in diameter. When full grown, the grubs leave the skin, drop to the ground, and later become adult flies.

The grubs, embedded beneath the skin, do not seem to annoy minks to any great extent. However, they may readily be removed by squeezing them out or by drawing them out with a pair of thumb forceps.

Other Fly Maggots

Several of the flesh flies are attracted by decaying animal and vegetable tissue. If such material is present in mink pens, fly maggots may be expected. Should the area around the anus of the mink become soiled, this may readily attract

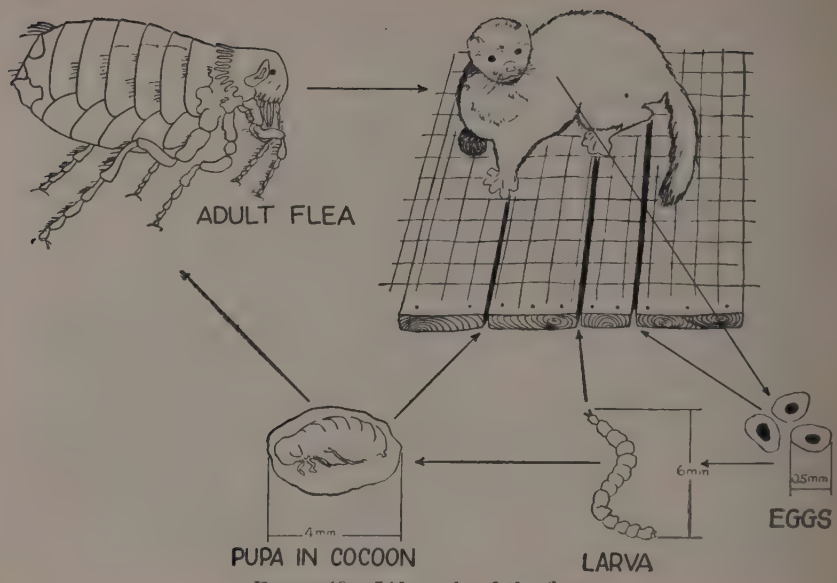

FIGURE 19.—Life cycle of the flea.

flies. Animals having a wound or sore may become infested with fly maggots, which, if not removed, may cause death. Carefully wash such infested areas with a mild disinfectant and screen the pen against the flies.

Fleas and Lice

Minks are not commonly infested with fleas. When they are, however, they may suffer considerably. When foxes and minks are kept in the same enclosure, the common fox flea (*Ctenocephalides canis*) may appear on minks. Such an invasion is transient, however, for this flea prefers feeding on foxes.

The regular mink flea (*Ceratophyllus vison*), when present in large numbers, is very detrimental to the health of minks. As these insects feed on blood, they may produce a marked anemia and also cause the animals to become restless and gradually lose weight. Pelts may be damaged by continuous scratching, as well as from the excreta from the fleas, which becomes intermingled with hair and skin excretions.

Lice on minks are rare. However, a biting louse (*Trichodectes retusus*) has attacked ranch-raised minks. Lice may be very annoying. They blemish pelts by attaching their eggs to hairs, which sometimes causes loss of fur.

Control.—Fleas reproduce by laying eggs on an animal's body or in the dust and litter in the nest box. As the eggs are not sticky, those laid on the animal soon drop off into the bedding or litter. Flea control is aimed at killing the adult forms on the host, as well as the immature forms in the dirt and cracks and crevices of nest boxes and kennels.

To destroy the young stages—eggs, larvae, and pupae (fig. 19)—remove all the litter and debris from the nest boxes and pens. Burn this material. Then scrub with hot water and lye; 13 ounces of lye to 15 gallons of water makes a suitable cleaning and disinfecting solution.

To destroy the adult fleas and lice, dust minks with a good insect powder. A suitable mixture is 1 part

of ground derris root to 2 parts of a carrier such as talcum powder, flour, or fuller's earth. Freshly ground pyrethrum or dusts impregnated with pyrethrum extracts may be substituted for derris root. Dusting should be done over a sheet of paper that can be folded up and burned. Repeat dusting treatments two or three times at intervals of 2 weeks to destroy the young lice or fleas that hatch from eggs.

With proper precautions, DDT may be used on the mink ranch. Emulsions and oil solutions containing 5-percent DDT should not be applied to minks or other animals. Spraying nest boxes with solutions of DDT and letting them dry thoroughly before minks are placed in them is a good control measure. In severe infestations, it may be necessary to dust 5-percent DDT powder into the fur or nest boxes. However, when using DDT around the pens, be sure that feed and water are not contaminated with the spray or dust.

Mange

Mange is rare in minks. When found, it has usually been traced to the introduction of fitches or ferrets or to the contamination of ranch equipment by infested fitches.

Mange mites (*Sarcoptes* sp.) are prolific. They burrow under the skin and they are minute; therefore, they are not readily visible to the naked eye. Ordinarily, the disease they cause is not recognized until it has gained a good foothold. The infested areas become extremely itchy, whereupon the animals bite and scratch in an effort to get relief. Scabs form over the infested area, and the legs and feet, which frequently become infested early, become greatly enlarged and covered with brownish scabs and crusts (fig. 20).

If mange is suspected in a minkery, have the diagnosis confirmed by microscopic examination. Kill and burn affected animals immediately. As this is a serious contagious disease, consult a veterinarian whenever any animals have a scabby skin associated with itching. The diagnosis, control, and treatment should be undertaken under the direct supervision of a veterinarian.

Other Mites

Minks have been found infested with tyroglyphid and cheyletid mites, but not often. Though not generally parasites of minks, they may cause considerable fur damage. Tyroglyphid mites are usually found in stored foods, dried meats, grains, and flour and other cereals, but at times they may attack small animals or even man. Cheyletid mites may be free-living, but they also have been found on field or house mice and other small rodents where they may be parasitic.

Sometimes these mites are brought into the minkery with food products and may be found by the millions in litter, bedding, or nestbox dust. When the mites get on minks they cause considerable irritation. The minks seek relief by scratching and rubbing, which destroys the guard hairs on their sides and tails.

This pest may be controlled by scrupulous cleaning of pens and nest boxes. Transfer infested animals to clean quarters, remove all litter, and scrub dirty pens with hot water and lye. Spraying the pens and nest boxes with a solution of DDT and letting them dry thoroughly before minks are placed in them may help to keep down such pests.

INTERNAL PARASITES

Coccidia

Coccidiosis, a disease caused by coccidia, minute protozoan forms, may become rampant in minkeries and cause heavy mortality among kits. The disease is most frequent in summer or early fall and appears

FIGURE 20.—Ferret's foot with severe lesions from mange.

to be equally prevalent in dry and wet seasons. Coccidiosis usually infects animals kept on earth and board flooring, but it may also infect those kept on wire flooring. Before wire netting for flooring became standard in pen construction, losses among minks from coccidiosis were extensive. In the early days, this disease probably was one of the major single factors in kit mortality. Both ranch-raised and wild minks may become infected. Adult minks often act as carriers of coccidia and, though they show no symptoms, may be a source of

infection for the kits. The parasite lives in the intestinal tract, and the infective forms (oocysts) are passed out with the manure. The oocysts develop further outside the body, and the animal becomes infected by swallowing them with contaminated feed and water. Once swallowed, the oocysts develop rapidly and liberate great numbers of tiny bodies. These invade the cells of the gut wall, thereby producing much irritation and injury. The young parasites, in turn, produce oocysts that pass out with the droppings and repeat the life cycle within about 2 weeks (fig. 21).

Symptoms.—The severity of coccidiosis depends on the extent of infection and the individual's resistance. The symptoms, therefore, are not always clear-cut and specific. Usually the first symptom noted is the passing of droppings coated with mucus. The appetite may become irregular and impaired; the fur, rough and lusterless and frequently faded. Progressive weakness and loss of flesh usually follow; if the disease is associated with distemper or some other malady, losses may be great. Coccidiosis may also be chronic, especially in older animals. It runs its course in 4 to 10 weeks, after which the animal will have built up an immunity. Usually an outbreak of coccidiosis runs its course and the losses cease without treatment.

Prevention and treatment.—As yet there is no remedy that will control coccidiosis. If the disease has not gained too great a foothold, good feed and nursing, together with good sanitation, may help greatly. Modern ranching methods and pen construction have aided in eliminating this disease. When minks are kept under insanitary conditions, reinfection is continuous. Use pens with suitable types of elevated wire floors and keep feed and water troughs scrupulously clean.

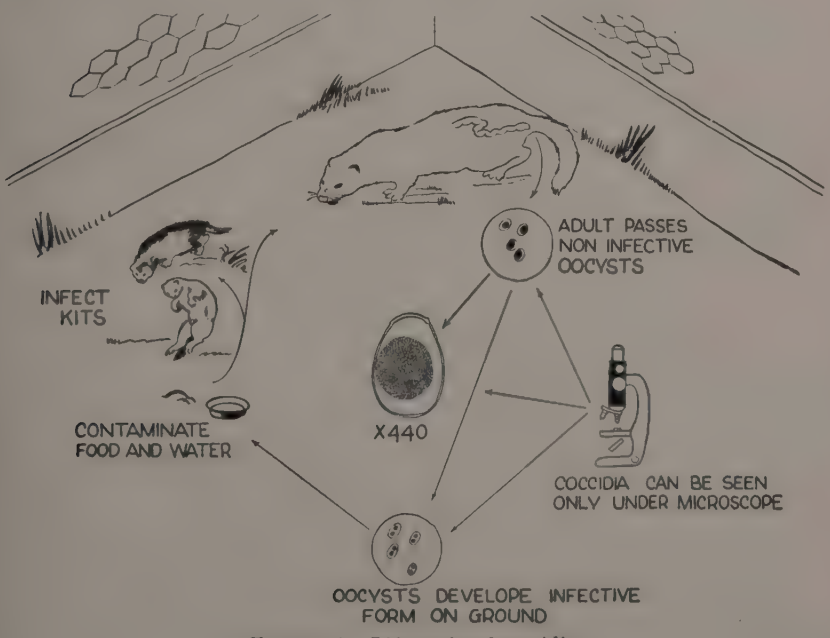

FIGURE 21.—Life cycle of coccidia.

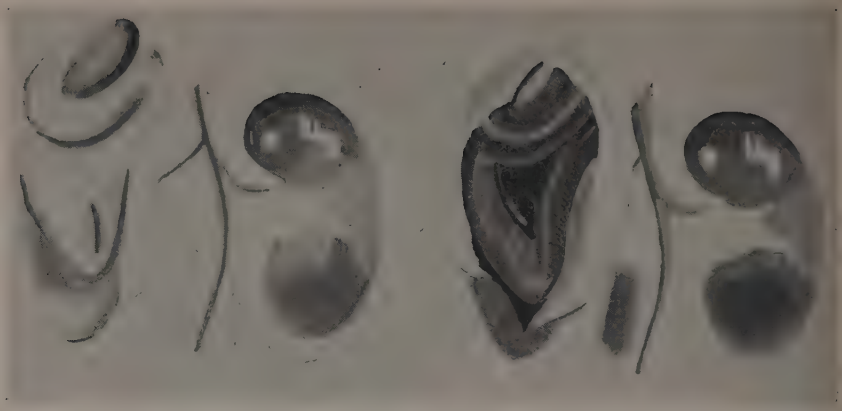

FIGURE 22.—Mink kidney cut open (right) to show the giant kidney worm within.

Roundworms of Digestive Tract

Generally speaking, ranch-raised minks are not seriously affected by roundworms, a hazard of the fox industry some years ago. Several species of roundworms from wild minks have been reported, but none appear to have caused serious losses in ranch-raised animals.

Ascarids, commonly present in the intestines of foxes and dogs, are seldom found in minks, though it has been reported that animals infected with *Ascaris* sp. may show some diarrhea and intestinal disturbance. A fine threadlike worm (*Capillaria* sp.) has been observed as an occasional intestinal parasite of minks, but the harm done by it has not been determined.

Roundworms of Kidney

The kidney worm, *Dioctophyma renale*, commonly called the giant kidney worm (fig. 22), has been recorded from both wild and ranch-raised minks. It measures up to a quarter of an inch in diameter and 12 inches in length. The worm, reddish in color, is usually found within the kidney, though it has been found also free in the abdominal cavity. As a rule, only one kidney is affected and usually only one worm is present.

The life cycle of this worm is complicated. Its eggs, passed in the urine, develop slowly into small leechlike worms (branchiobdellid) that are parasitic on crayfish. Minks become infected by eating these parasites encysted in the bodies of bullheads.

The presence of this worm in one kidney does not usually give rise to any symptoms. If both kidneys become infected, which is unusual, the animal will die. Because no curative treatment is known, control is based on prevention of infestation. Bullheads suspected of coming from infected sources should be cooked before being used for mink feed.

Trichinae

Trichinosis, a serious and often fatal human disease resulting from an infection with *Trichinella spiralis*, sometimes infests minks. Trichinae—small, slender worms—are acquired through eating raw meat containing encysted larvae. Infection may be prevented by thoroughly cooking meat and meat scraps fed to minks.

Guinea Worms

Guinea worms (*Dracunculus insignis*), which infest dogs and foxes, have also been found in ranch-raised minks. This worm is

an elongated, cylindrical, white nematode, the width varying from 1 to 2 millimeters, the length of the female varying from 75 to 280 millimeters. The worms are found just under the skin. By means of a small opening through the skin, the female liberates a mass of living larvae when the skin comes in contact with water. These young worms, free in the water, are swallowed by a water flea (*Cyclops* sp.), in which they develop further. Minks become infected by drinking water containing infective cyclops. This worm does not appear to cause much harm or inconvenience to its host. A closely related species is transmissible to man by way of contaminated water; hence, precaution should be taken to destroy and dispose of infected animals.

Tapeworms

Tapeworms of several kinds have been recorded but they are not very common in captive minks. They are found in the small intestine, where they do not appear to cause any marked symptoms or lesions. It is possible that the muskrat may act as an intermediate host for some of these tapeworms. Therefore, do not feed raw muskrat or muskrat livers to minks. Thoroughly cook fish showing any bladderlike cysts in the muscle or other tissues before feeding.

Lung Flukes (Flatworms)

As a rule, flukes are fairly common in wild furbearers, especially those that live in and around lakes and marshes. Occasionally flukes appear in ranch-raised minks, especially where raw fish, crayfish, frogs, or mice are fed.

The lung fluke (*Paragonimus kellicotti*) is fairly common in the midwestern United States. This parasite is not likely to become common among ranch-raised animals because of its complicated life cycle. The fluke ranges in length from 4 to 16 millimeters and in width from 4 to 8 millimeters. The parasites live in cystlike cavities in the lungs of minks. The cysts are fairly large and may appear on the lung surface as bluish raised areas. Cutting into the cysts may reveal one or more parasites bathed in a dark-brownish slimy fluid.

This fluke requires two intermediate hosts to complete its life cycle—the first a species of snail, the second a crayfish. Minks become parasitized by eating infected crayfish. If crayfish are used for mink feed they should be boiled.

As this parasite inhabits the lungs, the usual symptom is a cough. Heavy infections may cause death of the animal. Elimination of the fluke by treatment is unsatisfactory.

Intestinal Flukes

Several species of flukes, ranging in length from 1 to 3 millimeters, may be found in wild or ranch minks. These forms do not seem to be very harmful to minks, though infected animals may not do well, may show some diarrhea, and may have harsh, lusterless, dry pelts. As the life cycle of each of these flukes involves one or more intermediate hosts, the second one usually being a fish, crayfish, or frog, infection among ranch-raised minks may be prevented by cooking such feed or by subjecting it to prolonged freezing.

Liver Flukes

A liver fluke (*Metorchis conjunctus*) occurs in both wild and ranch-raised minks. Some mink ranchers have suffered severe losses from this parasite. This fluke infects the gall bladder and bile ducts. Symptoms are irregular appetite, general unthriftiness, weakness, jaundice, and anemia. No treatment for this fluke is known. As the infective stage of its development is passed in the common

sucker, infection may be prevented by cooking this fish before feeding it to minks.

EXAMINATION OF FECES FOR PARASITE EGGS

If minks are not doing well, and there is reason to suspect that they are infested with parasites, it is advisable to have a specimen of feces examined for parasite eggs or cysts. The presence of internal parasites in living animals may usually be determined by microscopic examination of fresh droppings. Most internal parasites produce large numbers of eggs within the host's intestine. Finding these eggs in the manure confirms the presence of the parasite in the animal. Whole worms or parts of them may occasionally be passed with the droppings and can sometimes be seen.

Collection and Preparation of Samples

For a preliminary survey or routine check, collect composite samples of feces from the pens. Number each sample to correspond to the pen or animal number. Samples collected should be fresh; satisfactory and reliable results cannot be obtained with old, dried manure. Pick up the samples with a small wooden stick (fig. 23) or spoon. They should be as free as possible from dirt, bedding, sand, stones, etc. New sticks and separate containers must be used for each sample in order to avoid contamination. Examine the samples promptly. Many worm eggs and protozoan cysts develop quickly once passed to the outside in the manure. If examination is delayed, keep samples on ice or in a 10-percent formalin solution.

Direct Smear.—The direct-smear method is the simplest and quickest way of preparing fecal material for examination for worm eggs. By its use, moderate to heavy infections can be detected, though light infections may be overlooked. The minute parasite eggs can be seen only with the aid of a microscope.

Place a drop of clean water on a 3- by 1-inch glass slide. With a match or toothpick, take small bits of fecal material at random from several parts of the sample of droppings. Mix the fecal material with the drop of water with a rotary motion. Then place a clean cover glass over the preparation. The smear is now ready to be examined (fig. 24).

Straining, Sedimenting, and Concentrating

Parasite eggs are easier to find if the coarse material of the fecal sample has been removed and if the eggs are concentrated. This may be accomplished by the process of sieving, straining, and sedimenting. Mix the feces thoroughly with about a pint of water by shaking and stirring. Then strain the mixture through a fine sieve, or one or two thicknesses of cheesecloth, to remove the coarse particles. The liquid which passes through the sieve will contain the parasite eggs. These will settle to the bottom of the jar in 15 to 20 minutes. With a small glass tube or a clean straw, transfer a drop or two of the sediment to a glass slide for examination under the microscope.

Flotation Method

A method commonly used for separating worm eggs is concentrating and floating parasite eggs to the surface of a fluid. The feces are mixed with a liquid of such density that the eggs are lighter than the suspending fluid and hence float to the surface. Two fluids commonly used for the purpose are saturated salt solution and a sugar solution. The worm eggs will float to the top within 15 to 20 minutes and can then be looped off with a wire loop or glass rod, transferred

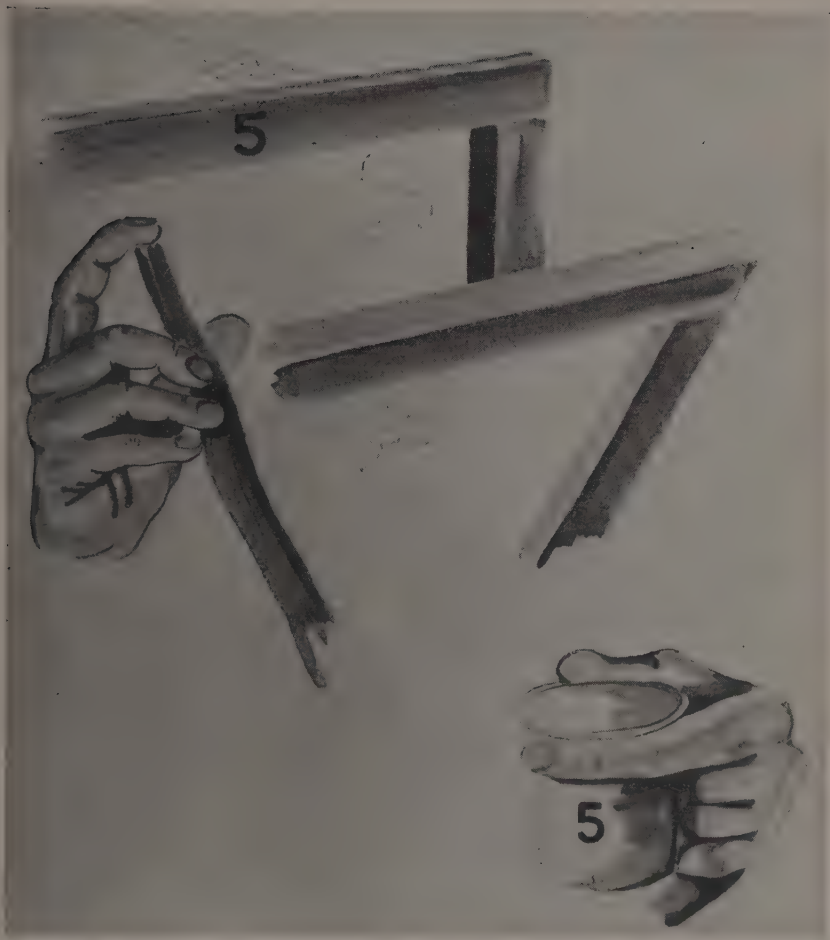

FIGURE 23.—Collecting, with a stick, a sample of manure (left) to be placed in a container (lower right) labeled with the pen number (upper left).

to a slide, and examined under the microscope. This method is excellent for certain species of eggs; but fluke eggs may fail to rise to the surface without rupturing.

Examination of Slide

When the material is ready for examination, place the slide on the microscope stage and reduce the light so the transparent objects stand out clearly. Beginning at the upper right-hand corner of the cover glass, move the slide slowly back and forth from side to side; examine systematically until the entire slide has been examined. The examination will reveal many structures that can be mistaken for parasite eggs or cysts. Eggs are identified by comparing the objects seen with drawings or photographs of the eggs. With practice, worm eggs and protozoan cysts may be readily identified; however, the personal aid of one acquainted with these eggs is of much help to the beginner.

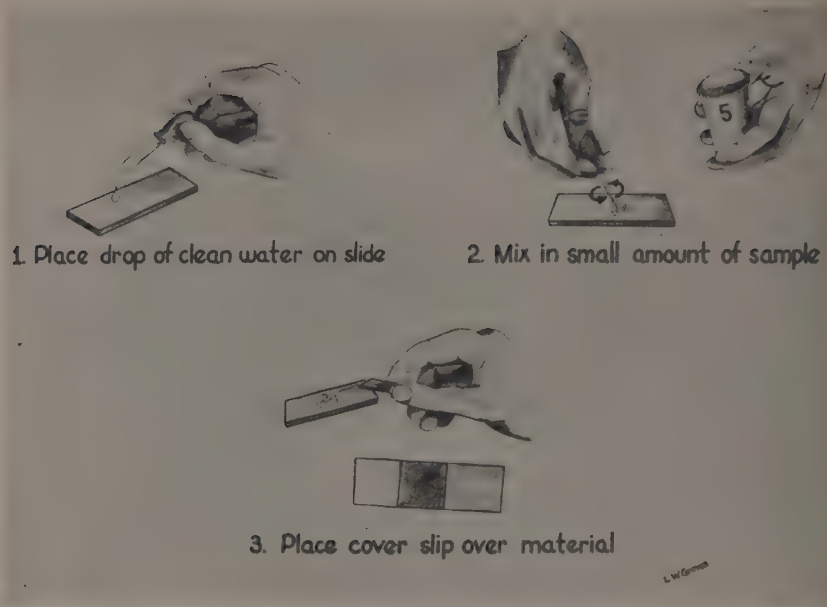

FIGURE 24.—Preparing feces for examination for worm eggs by the direct-smear method.

HOW TO PACK AND SHIP SPECIMENS FOR LABORATORY DIAGNOSIS

"Upon arrival, the carcass of your animal was decomposed and could not be used for examination. If available, we suggest you send additional animals."

This statement is often made in answer to some rancher's serious problem. Much time is lost. Often by the time additional animals are received, properly packed, it is too late to stop further losses. A satisfactory post mortem examination cannot be performed on a decomposed animal, because signs of disease that may have been present are often changed or obscured entirely.

The best method of obtaining an accurate diagnosis is to take dead animals, or two or three sick animals showing typical symptoms, to the nearest laboratory. In that way the rancher is present to supply any additional information the pathologist may need. If this is not convenient, the dead animals may be shipped.

SHIPPING DEAD ANIMALS

If the carcass is to be shipped a short distance, chill it thoroughly and place it in the center of a box containing sawdust or shavings (fig. 25). When the distance is greater, place dry ice around the carcass, then pack it as indicated above. Never put dry ice in an airtight jar or can. When the ice melts, gas is formed; if the gas cannot escape, it may cause an explosion. Properly used, dry ice will prevent spoilage for 2 to 3 days.

If dry ice is not available, place the animal in a can with a tight lid (1- or 2-pound coffee cans are a convenient size for minks), freeze solid, and pack in crushed ice surrounded by sawdust to take up the water. A wooden box can be used for shipment, but if a bucket, such as a lard container, can be substituted for a wooden box, no sawdust is necessary.

Many specimens decompose after arriving if no one is available to take care of them promptly. With this in mind, do not send fresh specimens that will arrive on a week end; most laboratories do not operate on Saturday or Sunday. Address the package to the laboratory itself, not to an individual employee. This will insure more immediate attention.

Do not send carcasses that have started to decompose. It is better to kill an animal or two that show typical symptoms, or to ship them alive if there is a chance that they may reach their destination before death.

THE ACCOMPANYING LETTER

Letters that do not contain sufficient information are a problem to the pathologist. In cases of Chastek's paralysis or botulism, a complete history is more useful than the carcass. The autopsy of an animal so affected will show little. The accompanying letter should contain the following information:

1. Number of minks on the ranch.
2. Number of animals showing symptoms; age of animals affected.
3. Number dead.
4. Dates of first losses and subsequent losses.
5. Description and duration of symptoms before death.
6. Feeding schedule for past 6 months.
7. If the animal has been pelted, the condition of the eyes (whether a discharge was present or not), condition of the coat and foot pads.
8. Incidence of infection (whether it is in just one house or pen, among one type of mutation, or scattered throughout the ranch).
9. What treatment, if any, has been given.

FIGURE 25.—Packing a dead animal to be shipped a short distance. The carcass, frozen solid, is placed in the center of a box containing sawdust or shavings.

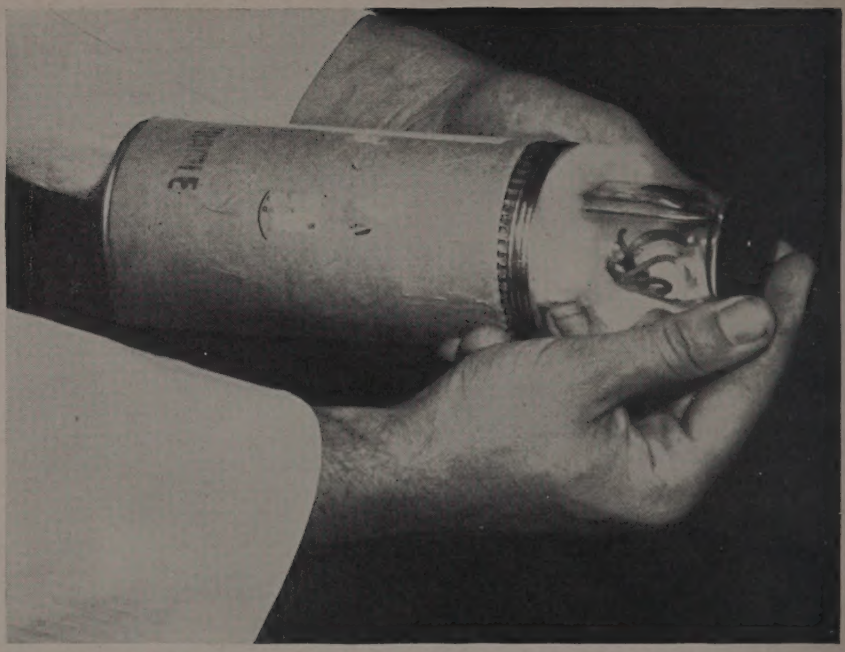

FIGURE 26.—Placing parasites to be submitted for identification in a stout glass jar containing 70-percent alcohol. The jar can then be wrapped in absorbent cotton and packed in a strong box or mailing tube.

10. Type of housing (whether the minks are kept on wire or in ground pens).
11. Any other information that might help explain the outbreak.

As it is against postal regulations to send frozen carcasses of diseased fur animals through the mail; shipment must be made by rail or air express. Place the written material inside the package. If cracked ice is used, place the letter where it cannot become soaked and illegible. Label the outside of the box, "Biological Specimen," "Rush," and "Keep in a Cool Place."

SHIPPING TISSUES IN FORMALIN

Sending tissues or organs in a preservative such as 10-percent formalin is often helpful in making diagnosis. This solution may be obtained from a local veterinarian or druggist. Send the whole bladder and brain, but only a piece of the kidney, spleen, liver, lung, stomach, and intestine. These pieces should be about the size of a postage stamp and a quarter of an inch thick. Use of 10-percent formalin has the disadvantage that it kills any bacteria or virus present. Therefore, bacterial studies or viral inoculations cannot be made from tissue thus packed.

SHIPPING PARASITES

Ship fleas, lice, flies, maggots, mange mites, and internal parasites for identification in a clean tight bottle (fig. 26) containing 70 percent alcohol, obtainable from a local veterinarian or druggist. Do not allow the parasites to dry out before sending them, and always put them in a preserving fluid. If the animals' feces are to be checked for parasite eggs, place a small amount

in 10-percent formalin. Number each sample and put it in a clean jar.

Tissues and feces in 10-percent formalin, or parasites in 70-percent alcohol, may be sent by domestic mail. Postal regulations require that they be placed in stout glass jars not more than 3 inches in diameter with tight-fitting lids. Wrap the jars in absorbent cotton or other suitable absorbent material in sufficient quantity to absorb all the fluid in case of breakage, and then pack them in strong boxes or mailing tubes.

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